

### **P-3.4 Explain, both conceptually and quantitatively, the factors that influence periodic motion.**

Revised Taxonomy Levels 2.7 B Explain conceptual knowledge

#### **Key concepts**

Periodic motion

In physical science, students may discuss pendulums but only in terms of the transformation of kinetic and potential energy, not in terms of periodic motion

#### **It is essential for students to**

- ❖ Understand that when a body moves repeatedly over the same path in equal intervals of time, it is said to have periodic motion.
- ❖ Understand that “simple harmonic motion” is a type of periodic motion which has the following characteristics
  - It is linear motion
  - A continually changing net force is exerted on the object
    - ◆ The magnitude of the net force decreases as the object moves towards the point of equilibrium.
    - ◆ The magnitude of the net force increases as the object moves away from the point of equilibrium.
  - Because the net force is continually changing, the rate of acceleration is continually changing.
    - ◆ The rate of acceleration is proportional to the displacement from the equilibrium position
    - ◆ The rate of acceleration decreases as the object moves towards the point of equilibrium.
    - ◆ The rate of acceleration increases as the object moves away from the point of equilibrium.
  - As the object is accelerating, the speed of the object is continually changing.
    - ◆ As the object moves toward equilibrium, there is a decreasing net force acting on it in the direction of the equilibrium position.
    - ◆ The decreasing net force causes a decreasing acceleration
    - ◆ Even though the rate of acceleration is decreasing as the object moves towards equilibrium, the object is still accelerating the entire time that it is moving toward the equilibrium position.
    - ◆ So the object continually speeds up as it moves towards the equilibrium position
    - ◆ The speed of the object is at a maximum at the point of equilibrium
    - ◆ At the point of equilibrium, the direction of the net force changes
    - ◆ The new net force causes an acceleration, but this time in the direction opposite to the motion of the object
    - ◆ As the object moves past the equilibrium point, the net force causes the object to accelerate by slowing down.
    - ◆ The speed of the object is at a minimum when the object is at the points farthest from the equilibrium and at a maximum at the point of equilibrium
    - ◆ The speed of the object is inversely proportional to the displacement from the equilibrium position

- ❖ Explain (both qualitatively and quantitatively) the motion of a pendulum and the motion of a weight hanging on a spring based on the principles of simple harmonic motion

### **Physics for the Technologies differentiation**

- ❖ Explain the relationship between elastic potential energy and an object's position

### **Assessment**

The verb explain means that the major focus of assessment should be for students to “construct a cause and effect model”. In this case, assessments will ensure that students can model how the motion of familiar objects in terms of simple harmonic motion

Because the indicator is written as conceptual knowledge, assessments should require that students understand the “interrelationships among the basic elements within a larger structure that enable them to function together.” In this case, assessments must show that students can construct a cause and effect statement relating how each variable (force, acceleration and velocity) are involved in specific energy transformations.